

WHAT IS CLAIMED IS:

1. A liquid crystal display device comprising:
 - a liquid crystal layer sandwiched between a first substrate and a second substrate,
 - one dot including a reflective display region used for reflective display and a transmissive display region used for transmissive display,
 - the liquid crystal layer includes a nematic liquid crystal having negative permittivity anisotropy oriented substantially perpendicularly to the substrates,
 - a first retardation film and a first polarizer being disposed in this order on the outer side of the first substrate,
 - a second retardation film, a second polarizer and an illuminating device being disposed in this order on the outer side of the second substrate, and
 - at least one of the first retardation film and the second retardation film having optical biaxiality. ✓
2. A liquid crystal display device comprising:
 - a liquid crystal layer sandwiched between a first substrate and a second substrate,
 - one dot including a reflective display region used for reflective display and a transmissive display region used for transmissive display,
 - the liquid crystal layer including a nematic liquid crystal having negative permittivity anisotropy oriented substantially perpendicularly to the substrates,
 - a first retardation film having optical biaxiality and a first polarizer being disposed in this order on the outer side of the first substrate, and
 - a second retardation film having optical biaxiality, a second polarizer and an illuminating device being disposed in this order on the outer side of the second substrate. 3
3. -- A liquid crystal display device comprising:
 - a liquid crystal layer sandwiched between a first substrate and a second substrate,
 - one dot including a reflective display region used for reflective display and a transmissive display region used for transmissive display,
 - the liquid crystal layer including a nematic liquid crystal having negative permittivity anisotropy oriented substantially perpendicularly to the substrates,
 - a first retardation film having optical biaxiality and a first polarizer being disposed in this order on the outer side of the first substrate, and

a third retardation film having optically negative uniaxiality, a fourth retardation film having optically positive uniaxiality, a second polarizer and an illuminating device being disposed in this order on the outer side of the second substrate.

4. A liquid crystal display device comprising: 4
 a liquid crystal layer sandwiched between a first substrate and a second substrate,
 one dot including a reflective display region used for reflective display and a transmissive display region used for transmissive display,
 the liquid crystal layer including a nematic liquid crystal having negative permittivity anisotropy oriented substantially perpendicularly to the substrates,
 a first retardation film having optical biaxiality and a first polarizer being disposed in this order on the outer side of the first substrate, and
 a fourth retardation film having optically positive uniaxiality, a second polarizer and an illuminating device being disposed in this order on the outer side of the second substrate.

5. A liquid crystal display device comprising: 5
 a liquid crystal layer sandwiched between a first substrate and a second substrate,
 one dot including a reflective display region used for reflective display and a transmissive display region used for transmissive display,
 the liquid crystal layer including a nematic liquid crystal having negative permittivity anisotropy oriented substantially perpendicularly to the substrates,
 a fifth retardation film having optically negative uniaxiality, a sixth retardation film having optically positive uniaxiality and a first polarizer being disposed in this order on the outer side of the first substrate, and
 a second retardation film having optical biaxiality, a second polarizer and an illuminating device being disposed in this order on the outer side of the second substrate.

6. A liquid crystal display device comprising: 6
 a liquid crystal layer sandwiched between a first substrate and a second substrate,
 one dot including a reflective display region used for reflective display and a transmissive display region used for transmissive display,
 the liquid crystal layer including a nematic liquid crystal having negative permittivity anisotropy oriented substantially perpendicularly to the substrates,

a sixth retardation film having optically positive uniaxiality and a first polarizer being disposed in this order on the outer side of the first substrate, and

a second retardation film having optical biaxiality, a second polarizer and an illuminating device being disposed in this order on the outer side of the second substrate.

7. The liquid crystal display device according to Claim 1, the thickness of the liquid crystal layer of the reflective display region being smaller than the thickness of the liquid crystal layer of the transmissive region.

8. The liquid crystal display device according to Claim 1, if the refractive indexes of the first retardation film and the second retardation film in the direction of a Z-axis, which is the direction of their thickness, are denoted by n_{z1} and n_{z2} , respectively, the refractive indexes thereof in the direction of an X-axis, which is one direction in the plane perpendicular to the Z-axis, are denoted by n_{x1} and n_{x2} , respectively, the refractive indexes thereof in the direction of a Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by n_{y1} and n_{y2} , respectively, and the thickness thereof in the Z-axis direction is denoted by $d1$ and $d2$, respectively, then $n_{x1} > n_{y1} > n_{z1}$ and $n_{x2} > n_{y2} > n_{z2}$ hold, and a sum $W1$ of the phase difference value within an XY plane and in the Z-axis direction in the first retardation film $((n_{x1} + n_{y1})/2 - n_{z1}) \times d1$ and the phase difference value in the second retardation film $((n_{x2} + n_{y2})/2 - n_{z2}) \times d2$ is expressed as $0.5 \times R_t \leq W1 \leq 0.75 \times R_t$ if the phase difference value of the liquid crystal layer in the transmissive region is denoted by R_t .

9. The liquid crystal display device according to Claim 3, if the refractive indexes of the first retardation film and the third retardation film in the direction of the Z-axis, which is the direction of their thickness, are denoted by n_{z1} and n_{z3} , respectively, the refractive indexes thereof in the direction of the X-axis, which is one direction in the plane perpendicular to the Z-axis, are denoted by n_{x1} and n_{x3} , respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by n_{y1} and n_{y3} , respectively, and the thickness thereof in the Z-axis direction is denoted by $d1$ and $d3$, respectively, then $n_{x1} > n_{y1} > n_{z1}$ and $n_{x3} \approx n_{y3} > n_{z3}$ hold, and a sum $W2$ of the phase difference value within the XY plane and in the Z-axis direction in the first retardation film $((n_{x1} + n_{y1})/2 - n_{z1}) \times d1$ and the phase difference value in the third retardation film $((n_{x3} + n_{y3})/2 - n_{z3}) \times d3$ is expressed as $0.5 \times R_t \leq W2 \leq 0.75 \times R_t$ if the phase difference value of the liquid crystal layer in the transmissive region is denoted by R_t .

10. The liquid crystal display device according to Claim 3, if the refractive indexes of the first retardation film, the third retardation film and the fourth retardation film in the

direction of the Z-axis, which is the direction of their thickness, are denoted by $nz1$, $nz3$ and $nz4$, respectively, the refractive indexes thereof in the direction of the X-axis, which is one direction in the plane perpendicular to the Z-axis, are denoted by $nx1$, $nx3$, and $nx4$, respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by $ny1$, $ny3$ and $ny4$, respectively, and the thicknesses thereof in the Z-axis direction are denoted by $d1$, $d3$ and $d4$, respectively, then $nx1 > ny1 > nz1$ and $nx3 \approx ny3 > nz3$ and $nx4 > ny4 \approx nz4$ hold, and the sum $W2$ of the phase difference value within the XY plane and in the Z-axis direction in the first retardation film $((nx1+ny1)/2-nz1) \times d1$, the phase difference value in the third retardation film $((nx3+ny3)/2-nz3) \times d3$, and the phase difference value within the XY plane and in the Z-axis direction of the fourth retardation film $((nx4+ny4)/2-nz4) \times d4$ is expressed as $0.5 \times Rt \leq W2 \leq 0.75 \times Rt$ if the phase difference value of the liquid crystal layer in the transmissive region is denoted by Rt .

11. The liquid crystal display device according to Claim 4, if the refractive indexes of the first retardation film and the fourth retardation film in the direction of the Z-axis, which is the direction of their thickness, are denoted by $nz1$ and $nz4$, respectively, the refractive indexes thereof in the direction of the X-axis, which is one direction in the plane perpendicular to Z-axis, are denoted by $nx1$ and $nx4$, respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by $ny1$ and $ny4$ respectively, and the thicknesses thereof in the Z-axis direction are denoted by $d1$ and $d4$, respectively, then $nx1 > ny1 > nz1$ and $nx4 > ny4 \approx nz4$ hold, and the sum $W2$ of the phase difference value within the XY plane and in the Z-axis direction in the first retardation film $((nx1+ny1)/2-nz1) \times d1$ and the phase difference value within the XY plane and in the Z-axis direction in the fourth retardation film $((nx4+ny4)/2-nz4) \times d4$ is expressed as $0.5 \times Rt \leq W2 \leq 0.75 \times Rt$ if the phase difference value of the liquid crystal layer in the transmissive region is denoted by Rt .

12. The liquid crystal display device according to Claim 5, if the refractive indexes of the second retardation film and the fifth retardation film in the direction of the Z-axis, which is the direction of their thickness, are denoted by $nz2$ and $nz5$, respectively, the refractive indexes thereof in the direction of the X-axis, which is one direction in the plane perpendicular to the Z-axis, are denoted by $nx2$ and $nx5$, respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by $ny2$ and $ny5$, respectively, and the thicknesses thereof in the Z-axis

direction are denoted by d_2 and d_5 , respectively, then $n_{x2} > n_{y2} > n_{z2}$ and $n_{x5} \approx n_{y5} > n_{z5}$ hold, and a sum W_3 of the phase difference value within the XY plane and in the Z-axis direction in the second retardation film $((n_{x2} + n_{y2})/2 - n_{z2}) \times d_2$ and the phase difference value in the fifth retardation film $((n_{x5} + n_{y5})/2 - n_{z5}) \times d_5$ is expressed as $0.5 \times R_t \leq W_3 \leq 0.75 \times R_t$ if the phase difference value of the liquid crystal layer in the transmissive region is denoted by R_t .

13. The liquid crystal display device according to Claim 5, if the refractive indexes of the second retardation film, the fifth retardation film and the sixth retardation film in the direction of the Z-axis, which is the direction of their thickness, are denoted by n_{z2} , n_{z5} and n_{z6} , respectively, the refractive indexes thereof in the direction of the X-axis, which is one direction in the plane perpendicular to Z-axis, are denoted by n_{x2} , n_{x5} , and n_{x6} , respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by n_{y2} , n_{y5} and n_{y6} , respectively, and the thicknesses thereof in the Z-axis direction are denoted by d_2 , d_5 and d_6 , respectively, then $n_{x2} > n_{y2} > n_{z2}$, $n_{x5} \approx n_{y5} > n_{z5}$ and $n_{x6} > n_{y6} \approx n_{z6}$ hold, and the sum W_3 of the phase difference value within the XY plane and in the Z-axis direction in the second retardation film $((n_{x2} + n_{y2})/2 - n_{z2}) \times d_2$, the phase difference value in the fifth retardation film $((n_{x5} + n_{y5})/2 - n_{z5}) \times d_5$, and the phase difference value within the XY plane and in the Z-axis direction in the sixth retardation film $((n_{x6} + n_{y6})/2 - n_{z6}) \times d_6$ is expressed as $0.5 \times R_t \leq W_3 \leq 0.75 \times R_t$ if the phase difference value of the liquid crystal layer in the transmissive region is denoted by R_t .

14. The liquid crystal display device according to Claim 6, if the refractive indexes of the second retardation film and the sixth retardation film in the direction of the Z-axis, which is the direction of their thickness, are denoted by n_{z2} and n_{z6} , respectively, the refractive indexes thereof in the direction of the X-axis, which is one direction in the plane perpendicular to Z-axis, are denoted by n_{x2} and n_{x6} , respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by n_{y2} and n_{y6} , respectively, and the thicknesses thereof in the Z-axis direction are denoted by d_2 and d_6 , respectively, then $n_{x2} > n_{y2} > n_{z2}$ and $n_{x6} > n_{y6} \approx n_{z6}$ hold, and the sum W_3 of the phase difference value within the XY plane and in the Z-axis direction in the second retardation film $((n_{x2} + n_{y2})/2 - n_{z2}) \times d_2$ and the phase difference value within the XY plane and in the Z-axis direction in the sixth retardation film $((n_{x6} + n_{y6})/2 - n_{z6}) \times d_6$ is expressed as $0.5 \times R_t \leq W_3 \leq 0.75 \times R_t$ if the phase difference value of the liquid crystal layer in the transmissive region is denoted by R_t .

15. The liquid crystal display device according to Claim 2, if the refractive indexes of the first retardation film and the second retardation film in the direction of the X-axis, which is one direction in the plane perpendicular to the direction of their thickness (Z-axis) are denoted by n_{x1} and n_{x2} , respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis are denoted by n_{y1} , n_{y2} ($n_{x1} > n_{y1}$, $n_{x2} > n_{y2}$), and the thicknesses thereof in the Z-axis direction are denoted by $d1$ and $d2$, respectively, then the X-axis of the first retardation film and the X-axis of the second retardation film are orthogonal to each other, and $(n_{x1} - n_{y1}) \times d1 = (n_{x2} - n_{y2}) \times d2$.

16. The liquid crystal display device according to Claim 3, if the refractive indexes of the first retardation film and the fourth retardation film in the direction of the X-axis, which is one direction in the plane perpendicular to the direction of their thickness (Z-axis), are denoted by n_{x1} and n_{x4} , respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis are denoted by n_{y1} , n_{y4} ($n_{x1} > n_{y1}$, $n_{x4} > n_{y4}$), and the thicknesses thereof in the Z-axis direction are denoted by $d1$ and $d4$, then the X-axis of the first retardation film and the X-axis of the fourth retardation film are orthogonal to each other, and $(n_{x1} - n_{y1}) \times d1 = (n_{x4} - n_{y4}) \times d4$.

17. The liquid crystal display device according to Claim 5 if the refractive indexes of the second retardation film and the sixth retardation film in the direction of the X-axis, which is one direction in the plane perpendicular to the direction of their thickness (Z-axis), are denoted by n_{x2} and n_{x6} , respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by n_{y2} , n_{y6} ($n_{x2} > n_{y2}$, $n_{x6} > n_{y6}$), and the thicknesses thereof in the Z-axis direction are denoted by $d2$ and $d6$, respectively, then the X-axis of the second retardation film and the X-axis of the sixth retardation film are orthogonal to each other, and $(n_{x2} - n_{y2}) \times d2 = (n_{x6} - n_{y6}) \times d6$.

18. The liquid crystal display device according to Claim 15, the first retardation film and the second retardation film being expressed by $100\text{nm} \leq (n_{x1} - n_{y1}) \times d1 = (n_{x2} - n_{y2}) \times d2 \leq 160\text{nm}$.

19. The liquid crystal display device according to Claim 16, the first retardation film and the fourth retardation film being expressed by $100\text{nm} \leq (n_{x1} - n_{y1}) \times d1 = (n_{x4} - n_{y4}) \times d4 \leq 160\text{nm}$.

20. The liquid crystal display device according to Claim 17, the second retardation film and the sixth retardation film being expressed by $100\text{nm} \leq (n_{x2} - n_{y2}) \times d2 = (n_{x6} - n_{y6}) \times d6 \leq 160\text{nm}$.

21. The liquid crystal display device according to Claim 1, the ratio $R(450)/R(590)$ of an in-plane phase difference value $R(450)$ of 450 nm to an in-plane phase difference value $R(590)$ of 590 nm in at least one of the first retardation film, the second retardation film, the fourth retardation film and the sixth retardation film being smaller than 1.

22. The liquid crystal display device according to Claim 1, the transmission axis of the first polarizer and the transmission axis of the second polarizer being orthogonal to each other.

23. The liquid crystal display device according to Claim 1, the phase difference value within the XY plane and in the Z-axis direction in the first retardation film $((n_{x1}+n_{y1})/2-n_{z1}) \times d1$ being substantially equal to the phase difference value in the second retardation film $((n_{x2}+n_{y2})/2-n_{z2}) \times d2$.

24. The liquid crystal display device according to Claim 3, the phase difference value in the XY plane and in the Z-axis direction in the first retardation film $((n_{x1}+n_{y1})/2-n_{z1}) \times d1$ being substantially equal to the phase difference value in the third retardation film $((n_{x3}+n_{y3})/2-n_{z3}) \times d3$.

25. The liquid crystal display device according to Claim 5, the phase difference value within the XY plane and in the Z-axis direction in the fifth retardation film $((n_{x5}+n_{y5})/2-n_{z5}) \times d5$ being substantially equal to the phase difference value in the second retardation film $((n_{x2}+n_{y2})/2-n_{z2}) \times d2$.

26. The liquid crystal display device according to Claim 1, if the refractive index of the first retardation film in the direction of the Z-axis, which is the direction of their thickness, is denoted by n_{z1} , the refractive index thereof in the direction of the X-axis, which is one direction in the plane perpendicular to the Z-axis, is noted as n_{x1} , and the refractive index thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, is denoted by n_{y1} , and the thickness thereof in the Z-axis direction is denoted by $d1$, then $n_{x1} > n_{y1} > n_{z1}$ holds, and the phase difference value within the XY plane and in the Z-axis direction in the first retardation film $((n_{x1}+n_{y1})/2-n_{z1}) \times d1$ is $0.5 \times R_r \leq ((n_{x1}+n_{y1})/2-n_{z1}) \times d1 \leq 0.75 \times R_r$ when the phase difference value in the liquid crystal layer in the reflective region is denoted by R_r .

27. The liquid crystal display device according to Claim 5, if the refractive index of the fifth retardation film in the direction of the Z-axis, which is the direction of their thickness, is denoted by n_{z5} , the refractive index thereof in the direction of the X-axis, which is one direction in the plane perpendicular to the Z-axis is noted as n_{x5} , and the refractive

index thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, is denoted by n_{y5} , and the thickness thereof in the Z-axis direction is denoted by d_5 , then $n_{x5} \approx n_{y5} > n_{z5}$ holds, and the phase difference value within the XY plane and in the Z-axis direction of the fifth retardation film $((n_{x5} + n_{y5})/2 - n_{z5}) \times d_5$ is $0.5 \times R_r \leq ((n_{x5} + n_{y5})/2 - n_{z5}) \times d_5 \leq 0.75 \times R_r$ when the phase difference value in the liquid crystal layer in the reflective region is denoted by R_r .

28. The liquid crystal display device according to Claim 5, if the refractive indexes of the fifth retardation film and the sixth retardation film in the direction of the Z-axis, which is the direction of their thickness, are denoted by n_{z5} and n_{z6} , respectively, the refractive indexes thereof in the direction of the X-axis, which is one direction in the plane perpendicular to Z-axis, are denoted by n_{x5} and n_{x6} , respectively, the refractive indexes thereof in the direction of the Y-axis, which is the direction perpendicular to the Z-axis and the X-axis, are denoted by n_{y5} and n_{y6} , respectively, and the thicknesses thereof in the Z-axis direction are denoted by d_5 and d_6 , respectively, then $n_{x5} \approx n_{y5} > n_{z5}$ and $n_{x6} > n_{y6} \approx n_{z6}$ hold, and a sum W_4 of the phase difference value within an XY plane and in the Z-axis direction of the fifth retardation film $((n_{x5} + n_{y5})/2 - n_{z5}) \times d_5$, and the phase difference value within the XY plane and in the Z-axis direction of the sixth retardation film $((n_{x6} + n_{y6})/2 - n_{z6}) \times d_6$ is expressed as $0.5 \times R_r \leq W_4 \leq 0.75 \times R_r$ if the phase difference value in the liquid crystal layer in the reflective region is denoted by R_r .

29. The liquid crystal display device according to Claim 1, wherein a reflection layer capable of reflecting incident light being formed in the reflective display region.

30. The liquid crystal display device according to Claim 1, the reflection layer having an irregular configuration capable of performing scattered reflection of incident light.

31. The liquid crystal display device according to Claim 1, the first retardation film and the second retardation film being orthogonal to each other in the X-axis direction, and the first retardation film and the second retardation film forming a substantially 45-degree angle with respect to the transmission axis of the first polarizer and the transmission axis of the second polarizer in the X-axis direction.

32. The liquid crystal display device according to Claim 3, the first retardation film and the fourth retardation film being orthogonal to each other in the X-axis direction, and the first retardation film and the fourth retardation film forming a substantially 45-degree angle with respect to the transmission axis of the first polarizer and the transmission axis of the second polarizer in the X-axis direction.

33. The liquid crystal display device according to Claim 5, the second retardation film and the sixth retardation film being orthogonal to each other in the X-axis direction, and the second retardation film and the sixth retardation film forming a substantially 45-degree angle with respect to the transmission axis of the first polarizer and the transmission axis of the second polarizer in the X-axis direction.

34. The liquid crystal display device according to Claim 1, the inner surface of at least either the first substrate or the second substrate, the surface being adjacent to the liquid crystal layer, being provided with an electrode having an opening to drive the liquid crystal.

35. The liquid crystal display device according to Claim 1, a protuberance being formed on the electrode formed on the inner surface of at least either the first substrate or the second substrate, the surface being adjacent to the liquid crystal layer.

36. The liquid crystal display device according to Claim 1, there are at least two liquid crystal directors in one dot when the liquid crystal being driven by the electrode.

37. Electronic equipment, comprising:
the liquid crystal display device according to Claim 1.